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EVALUATION OF TRACE METAL (Hg, B, Co, AND Al) LEVELS IN TISSUES OF SKIPJACK TUNA, *KATSUWONUS PELAMIS* (LINNAEUS, 1758) FISH FROM KARACHI FISH HARBOUR, KARACHI, PAKISTAN

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ABSTRACT: The level of four heavy metals Mercury (Hg), Boron (B), Cobalt (Co), Aluminum(Al) in muscle and liver of *Katsuwonus pelamis* fish. Fish sample of *Katsuwonus pelamis* were collected from fish harbour of Karachi during January 2007 and December 2007 for metal analysis. Samples were analyzed by AAS-700. The highest length (63cm) and weight (2700g) were recorded in this studied. The mean concentrations of Hg, B, Co and Al in muscle were recorded as 0.041, 0.069, 0.041and 0.030µg/g, respectively. However, the mean concentrations of Hg, B, Co and Al in liver tissues were found as 0.673, 0.725, 0.725 and 0.498µg/g, respectively.The highest concentration of B was found in both liver and muscle tissues in pre-monsoon and monsoon, and the lowest concentration of Al was found in liver tissues at pre-monsoon, monsoon and post-monsoon seasons. The results of this study show that Hg, Co and Al accumulations of *K. pelamis* caught from Karachi coast were generally below the international permissible levels. Therefore, metal accumulations in *K. pelamis* and all other fishes have to be monitored continuously in this region for human healthy. ANOVA analysis clearly revealed that there was a significant $p \leq 0.05$ in organ of fishes. Statistically significant differences were observed in the mean metal values from different seasons and tissues ($p<0.05$).

KEYWORDS: Heavy metals, *Katsuwonus pelamis* fish, fish harbour, Karachi, Pakistan.

INTRODUCTION

Fish have an important place in the diet of Pakistan and are a good source of digestible protein vitamins, minerals and polyunsaturated fatty acids (PUFA). However, fish are also source of metals. Some of the metals found in the fish might be essential as they play important role in biological system of the fish as well as in human being, some of them may also be toxic as might cause a serious damage in human health even in trace amount at a certain limit. The term of heavy metals has been replaced in years by a classification scheme that considers their chemistry rather than relative density (Nieboer and Richardson, 1980).

Fish may accumulate large amounts of some metals from the water and from their food and then deposit them in the tissue. Therefore it is important to determine the concentration of heavy metals in commercial fish in order to evaluate the possible risk of fish consumption to human health (Pérez-Cid *et al.,* 2001).

Large fish such as Swordfish (*Xiphiasgladius*), Yellowfin Tunas (*Tunnus albacares*), Skipjacks (*Katsuwonus pelamis*) and Common Dolphin fish (*Coryphaena hippurus*), which are at the top of marine food webs, are particularly exposed to high levels of trace elements through their food (Bryan, 1979). Several pollutants such as heavy metals like cadmium, lead and mercury are cumulative toxic, stable and not easy biodegradable (Ikem and Egibo, 2005).

Karachi is the biggest city of Pakistan and lies within the coordinates of 23º19 N and 24º07' N latitudes and 67º08' E and 68º54' E longitudes. The main sources of pollution in eastern part of Karachi are leather, paints, textile, pharmaceuticals, iron, steel, electrical appliances, refinery, oil, and electroplating industries and sewage water. Karachi is largest city, there are more than 65 categories of industrial plants in the established industrial estates including, textile industries, tanneries, pharmaceuticals, plastic and rubber industries, steel foundries, metallurgical industries, electroplating and metal coating industries, glass, ceramics and tiles industries, cement industry, soap and detergents, fish processing industries, chemical industries, power plants, fertilizers and pesticides edible oils, automobile cable and conductor manufacturing etc. (Shahid, 2010).

The objectives of this study is to determine concentrations of heavy metal (Hg, B, Co, Al) in skipjack tuna *Katsuwonus pelamis* (Linnaeus, 1758) caught during January, 2007 and December, 2007 for metal analysis.

MATERIALS & METHODS

K. pelamis (Linnaeus, 1758) fish samples were collected during Pre-monsoon (January to May), Monsoon (June to August) and Post-monsoon (September to December) seasons from Karachi coast. Six samples were collected in each season of the year. The sample was immediately transported to the laboratory, thawed and rinsed in distilled water to remove foreign particles. Fresh length in (cm) and weight in (g) were measured. Fish were tagged for identification and then freezed until time for analysis. After biometric measurements, approximately 2 g of the muscle on the dorsal surface of the fish from each sample were dissected and washed with distilled water, dried filter paper weighted, packed in polyethylene bags and kept at -20°C until analysis. Analyst 700 Atomic Absorption Spectrophotometer was used in the present study in Centralized Science Laboratory, University of Karachi. Due to the non-availability of the reference standard material, accuracy of analysis and the effect of the matrices in the media were controlled with the standard addition method. All studied elements were tested with standard addition method for 3 randomly selected samples. The samples taken from the muscles tissues were dried first and cut into pieces as small as possible. 3-20 mg portions were taken from the dried samples, placed into teflon cylindrical vessels and digested with 3 mL of H_2O_2/HNO_3 (1:2 v/v) at 250 ºC. The organic part was discarded and the remaining part was diluted with demineralized water up to 50 ml in a graduated flask (Bernhard, 1976).

The variation in heavy metal concentrations within muscles tissues of *K. pelamis* during three seasons were determined by analyses of variance (ANOVA) using Tukey's

HDS post-hoc comparison method. The results were evaluated on the basic of homogenous groups with a significance level of ($p<0.05$). The elements which were common in the muscle and liver tissues of *K. pelamis* were assessed by means of Pearson's correlation coefficients. Data collection and statistical calculations were performed by SPSS software (Ver.18).

RESULTS & DISCUSSION

In the present study, length and weight (min-max) of *K. pelamis* were 51 - 63 cm and 1300-2700 g (Table 1).

Table 2 shows the seasonal distributions and average values of Hg, B, Co and Al. Metal levels in liver were higher than those in muscle tissue. The highest mean concentrations of Hg, B, Co and Al in muscles were0.041,0.069, 0.041 and 0.030µg/g, respectively. However, the highest mean concentrations of Hg, B, Co and Al in liver were 0.673,0.725, 0.725 and 0.498µg/g, respectively.

Table 1. Seasonal length (cm) and weight (g) in *K. pelamis*

Seasons		Length (cm)	Weight (g)
Pre-monsoon	Minimum	51.000	1300.000
	Maximum	63.000	2700.000
	Mean	54.333	1666.667
	Std. Error of Mean	01.892	0217.051
Monsoon	Minimum	53.000	1500.000
	Maximum	61.000	2400.000
	Mean	56.167	1800.000
	Std. Error of Mean	01.302	0139.044
Post-monsoon	Minimum	54.000	1600.000
	Maximum	59.000	2000.000
	Mean	56.333	1800.000
	Std. Error of Mean	00.919	0073.030
Total	Minimum	51.000	1300.000
	Maximum	63.000	2700.000
	Mean	55.611	1755.556
	Std. Error of Mean	00.805	0085.261

The highest concentration of B was found both in liver and muscle tissues in the pre-monsoon and monsoon seasons, and the lowest level of Al was found in liver tissues in pre-monsoon, monsoon and post-monsoon.The metal levels in both muscle and liver tissues decreased in order B > Hg > Co > Al (Table 2).

Table 2. Seasonal heavy metal concentrations in *K. pelamis* (ug/g)

Seasons		Muscle				Liver			
		Hg	B	Co	Al	Hg	B	Co	Al
Pre-monsoon	Minimum	0.010	0.010	0.000	0.000	0.340	0.340	0.240	0.180
	Maximum	0.050	0.210	0.040	0.020	0.890	0.940	0.670	0.520
	Mean	0.029	0.069	0.014	0.007	0.635	0.690	0.500	0.336
	Std. Error of Mean	0.012	0.034	0.006	0.00	0.080	0.090	0.070	0.051
Monsoon	Minimum	0.020	0.010	0.010	0.000	0.490	0.540	0.210	0.210
	Maximum	0.090	0.090	0.060	0.060	0.910	0.960	0.980	0.640
	Mean	0.041	0.048	0.029	0.030	0.673	0.725	0.500	0.421
	Std. Error of Mean	0.009	0.013	0.007	0.010	0.065	0.066	0.117	0.060
Post-monsoon	Minimum	0.010	0.010	0.010	0.010	0.340	0.210	0.340	0.180
	Maximum	0.080	0.060	0.080	0.040	0.840	0.690	0.910	0.780
	Mean	0.037	0.024	0.041	0.024	0.571	0.498	0.725	0.498
	Std. Error of Mean	0.011	0.007	0.012	0.005	0.085	0.077	0.094	0.100
Total	Minimum	0.010	0.010	0.000	0.000	0.340	0.210	0.210	0.180
	Maximum	0.090	0.210	0.080	0.060	0.910	0.960	0.980	0.780
	Mean	0.035	0.047	0.027	0.020	0.626	0.637	0.575	0.418
	Std. Error of Mean	0.005	0.012	0.025	0.005	0.043	0.049	0.058	0.043

The overall order of high metal levels in the muscle tissues of *K. pelamis* were followed as monsoon, post-monsoon and pre-monsoon for Hg; pre-monsoon, monsoon, post-monsoon for B; post-monsoon, monsoon, pre-monsoon for Co; monsoon, post-monsoon, pre-monsoon for Al. However these values in the liver of *K. pelamis* were monsoon, pre-monsoon, post-monsoon for Hg, monsoon, pre-monsoon, post-monsoon for B, post-monsoon, monsoon, pre-monsoon for Al.

Statistically significant differences were observed in the mean metal values from different seasons and tissues ($p<0.05$).

Acestrorhynchus guianensis from the Amazon Basin (in French Guiana), which is polluted by gold mining, exhibits Hg levels as high as 4.3 $\mu g.g^{-1}$d.w. (Durrieu et al., 2005). Furthermore, mean Hg levels of 13 $\mu g.g^{-1}$d.w. has been reported for the small deep-sea Smooth Grenadier, (*Nezumiaaequalis*), found in the 500- 1750m bathymetric zones of the Rockall Trough, North West of the British Isles (Mormede and Davies, 2001).

Cobalt is an essential nutrient for humans, and also forms an integral part of vitamin B12 (Sivapermal *et al.,* 2007).The Hg values were well below the EC recommended value of 0.5–1.0μgg^{-1} (EU, 2001).The Co values were well below the FAO recommended value of 30 μgg^{-1} (FAO, 1983). No permissible guidelines/limits have yet been established for Co. Average boron contents of fish samples ranged from 0.17 to 1.87 $\mu g\ g^{-1}$. Yilmaz et al., (2010) have investigated the accumulation of boron in the fishes and they found below the limits of detection in all the tissues samples. Aluminum is not considered to be an essential element in humans. Exposure to aluminum has been implicated in a number of human pathologies including encephalopathy/dialysis dementia, Parkinson disease and Alzheimer's disease. The permissible aluminum dose for an adult is quite high (60 mg/day) (WHO, 1989).

The results of the present study supply valuable information about metal contents in organs of *K. pelamis* from the cost of Karachi and indirectly indicate the environmental contamination of the environment. Moreover, these results can also be used to understand the chemical quality of fish and to evaluate the possible risk associated with their consumption. Statistically significant differences were observed in the mean metal values from different seasons and tissues ($p<0.05$).

Because the levels of metals in all tissues of the examined fishes in this study were lower than maximum permissible levels.

The results of this study show that Hg, Co and Al accumulations of *K. pelamis* caught from Karachi coast were generally below the international permissible levels. Therefore, metal accumulations in *K. pelamis* and all other fishes have to be monitored continuously in this region for human healthy. The present study shows that precautions are needed to be taken in order to obviate metal pollution in future.

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